Appendix D
Stressor and management tables

Table 1: Activity-stressor relationships: stressors potentially caused by activities, including human actions and natural mechanisms

TABLE 1

		HUMAN ACTIONS																												NATURAL MECHANISMS										
		Shoreline development and uses									Spills and Discharges									Watershed activities				Biological resource harvest and culture									Marine										
can cause ↓	ACTIVITIES:	Existing shoreline structures--docks, piers, bridges	Existing shoreline structures--bulkheads	Existing shoreline structures--dikes, fills, impoundments	Existing shoreline structures--jetties	Existing shoreline structures--dredged channels	Existing shoreline structures--marinas/houseboats	Construction or repair of shoreline and in-water structures	Site clearing of marine riparian vegetation	Operation of shoreline & on-water facil./pub. util./indust.	Wastewater discharges to marine waters (WWTP, industry)	Wastewater discharges to fresh surface waters	Stormwater discharges to marine waters	Stormwater discharges to fresh waters	Spills/disch. of toxics/oil from vessels & shoreline facilities	Spills/disch. of toxics/oil from upland sites that reach water	Sewage, graywater, & bilge discharges from boats (including cruise ships)	Ballast water discharge	"Failing" on-site sewage treatment	Runoff from agricultural practices	Forest practices	Altering water flow by channeling, dams	Changes in freshwater flows via water removals & diversions	Commercial finfish harvest	Shellfish culture involving working the sediments	Floating aquaculture involving feeding (finfish)	Fish planting and hatchery releases	Introduction of diseases from aquacultural/planting activities	Introduction of new "exotic" species (aquaculture, etc)	Efforts to control invasive plants (e.g., *Spartina*)	Management activities altering marine mammal populations	Channel dredging & disposal, contamin. sed. dredging/capping	Anthropogenic causes of climate change		Tsunamis and vulcanism	Storms	Circulation, tidal mixing and turbulence	Natural blooms	Natural hypoxia	Natural loadings (within system)	Natural habitat changes	Natural variation in rainfall	Natural variation in runoff timing	Natural climate variation and ENSO
	STRESSORS[1]:																																							
1	Add toxics	✓		✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓					✓				✓						
2	Add nutrients							✓		✓	✓	✓	✓	✓			✓		✓	✓	✓				✓	✓										✓					
3	Alter sediment loadings (increase/decrease)		✓	✓							✓	✓	✓	✓			✓		✓	✓	✓	✓	✓			✓									✓					✓
3	Alter freshwater input			✓						✓	✓	✓	✓	✓					✓			✓	✓			✓									✓			✓	✓	✓
3	Reduce organic matter input	✓	✓	✓	✓				✓												✓	✓	✓									✓					✓	✓	✓
3	Alter runoff timing; increase strength of peak flows			✓										✓						✓	✓	✓	✓									✓					✓	✓	✓
4	Shading (e.g., subtidal vegetation)	✓	✓	✓	✓		✓	✓		✓																✓									✓				
4	Create physical disturbance via intrusion							✓	✓	✓											✓			✓	✓	✓				✓	✓				✓					
4	A change in depth or shoreline slope	✓	✓	✓	✓	✓	✓	✓														✓	✓								✓				✓					✓
4	Alter sediment type, incl. via water transp.	✓	✓	✓	✓	✓	✓	✓														✓	✓								✓			✓					✓
4	Produce noise	✓					✓	✓		✓												✓	✓						✓		✓								
4	Physically disturb the sediments							✓													✓	✓								✓				✓					
4	Reduce endemic benthic habitat area	✓	✓	✓	✓	✓	✓	✓														✓	✓				✓				✓	✓							✓
4	Sea level change																															✓	✓							
4	Alter seawater and intertidal temperature regime		✓						✓		✓		✓									✓	✓									✓				✓				✓
4	Impede water circulation (altered wave energy)	✓	✓	✓	✓																										✓			✓					
5	Introduction of exotic marine species																	✓								✓			✓										
5	Alter local marine species composition (including prey, competition and predation)	✓	✓	✓											✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓			
5	A change in marine organism abundance (including prey, competition and predation)	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

[1]Stressors arranged by: Contamination (1 = Toxics, 2 = Nutrients/Pathogens); Physical Environment Alterations (3 =Input Changes, 4 =Ambient Changes); Biota (5 =Status and Trends).

Adapted from Newton *et al.* (2000). A Conceptual Model for Environmental Monitoring of a Marine System. Puget Sound Ambient Monitoring Program.

Table 2: Activity-management relationships: management approaches to modify or regulate human actions

TABLE 2

MANAGEMENT:	ACTIVITIES:	Existing shoreline structures--docks, piers, bridges	Existing shoreline structures--bulkheads	Existing shoreline structures--dikes, fills, impoundments	Existing shoreline structures--jetties	Existing shoreline structures--dredged channels	Existing shoreline structures--marinas/houseboats	Construction or repair of shoreline and in-water structures	Site clearing of marine riparian vegetation	Operation of shoreline & on-water facil./pub. util./indust.	Wastewater discharges to marine waters (WWTP, industry)	Wastewater discharges to fresh surface waters	Stormwater discharges to marine waters	Stormwater discharges to fresh. waters	Spills/disch. of toxics/oil from vessels & shoreline facilities	Spills/disch. of toxics/oil from upland sites that reach water	Sewage, greywater, & bilge discharges from boats (including cruise ships)	Ballast water discharge	"Failing" on-site sewage treatment	Runoff from agricultural practices	Forest practices	Altering water flow by channeling, dams	Changes in freshwater flows via water removals & diversions	Commercial finfish harvest	Shellfish culture involving working the sediments	Floating aquaculture involving feeding (finfish)	Fish planting and hatchery releases	Introduction of diseases from aquacultural/planting activities	Introduction of new "exotic" species (aquaculture, etc)	Efforts to control invasive plants (e.g., *Spartina*)	Management activities altering marine mammal populations	Channel dredging & disposal, contamn. sed. dredging/capping	Anthropogenic causes of climate change
		Shoreline development and uses									**Spills/discharges**									**Watershed activities**				**Biological resource harvest and culture**								**Marine**	
		HUMAN ACTIONS																															
Education and outreach		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Corps permit		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								✓	✓		✓							✓	
DOTransportation construction standards		✓	✓	✓	✓	✓		✓	✓				✓	✓						✓		✓										✓	✓
farm plans									✓					✓		✓				✓													
HPA (Hydraulic Project Approval)		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓							?	✓			✓	✓						✓	
implementation of SMA (Shoreline Mgmt. Act)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓			✓			✓	✓						✓	
local implementation of GMA (Growth Mgmt Act)								✓	✓	✓			✓	✓					✓						✓	✓						✓	✓
Port districts		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓					✓											
shellfish aquaculture voluntary code of practice			?	✓				✓	✓	✓	✓		✓		✓	✓	✓		?						✓			✓	✓				
state and local on-site sewer sys. regs.								✓		✓					✓				✓														
state and local stormwater rules		?					✓	✓					✓	✓	✓	✓				✓													
water quality certification		✓		✓	✓	✓	✓	✓															✓			✓						✓	
zoning - building codes		✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓		✓										✓	
boater rules and sites							✓			✓					✓		✓												✓				
dredged material management (nee PSDDA)				✓				✓																								✓	
navigation rules		✓				✓	✓	✓		✓					✓		✓									✓	✓					✓	
NPDES (Natl. Pollut. Disch. Elimin. Sys.)										✓	✓	✓	✓	✓	✓	✓				✓		✓					✓						
spill prevention, preparedness, & response		✓					✓	✓		✓	✓	✓			✓	✓	✓																
state wastewater permit							✓				✓	✓	✓	✓	✓	✓			✓	✓		✓					✓						
park rules									?	✓					✓		✓																
proprietary requirements on state land		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓			✓	✓	✓	✓			✓	
reserves									?		✓	✓	✓	✓	✓	✓	✓		✓					✓	✓	✓						✓	
incentives and acquisition to protect functions								✓	✓	✓									✓	✓			✓										
aquaculture disease control regs.																												✓	✓				
Endangered Species Act																																	
forest practice rules									✓					✓		?					✓												
harvest limits/closures/areas/changes																								✓									
introduction permits																												✓	✓				
Marine Mammal Protection Act										✓																					✓		
state threatened/endang. spp. regs.																																	
water rights																							✓